ENGINE MOUNTING CONFIGURATION FOR A TURBOFAN GAS TURBINE ENGINE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to an engine mounting configuration, and more particularly to an engine mounting configuration for mounting a turbofan gas turbine engine to an aircraft pylon.

[0002] A gas turbine engine may be mounted at various points on an aircraft such as a pylon integrated with an aircraft structure. An engine mounting configuration ensures the transmission of loads between the engine and the aircraft structure. The loads typically include the weight of the engine, its thrust, aerodynamic loads, maneuver loads, and rotary torque about the engine axis. The engine mounting configuration must also absorb the deformations to which the engine is subjected during different flight phases and the dimensional variations due to thermal expansion and retraction.

[0003] One conventional engine mounting configuration includes a pylon having a forward mount and an aft mount. The front mount handles the thrust load from the engine as well as vertical and side loads from the front of the engine. The rear mount handles vertical and side loads from the rear of the engine and the engine torque.

[0004] Although effective, one disadvantage of this mounting arrangement is the relatively large "punch loads" into the engine cases from the thrust links which react the thrust from the engine and couple the thrust to the pylon. These loads tend to distort the intermediate case, low pressure compressor (LPC), fan, and high pressure compressor (HPC) cases. The distortion can cause the clearances between the static cases and rotating blade tips to increase. This may negatively affect engine performance and increase fuel burn.

[0005] Furthermore, when reacting thrust at the front mount, the engine centerline is deflected downward therefrom. The engine centerline may be still further deflected downward from the nacelle air load when the aircraft rotates while taking off. To accommodate this centerline deflection, the engine compressor and turbine blade require larger tip clearances which may negatively affect engine performance.

[0006] Accordingly, it is desirable to provide an engine mounting configuration which minimizes backbone bending and engine case distortion.

SUMMARY OF THE INVENTION

[0007] The engine mounting configuration according to the present invention reacts the engine thrust at an aft mount. This reduces engine backbone bending. By reacting thrust at the rear mount, the engine centerline is bent upwards therefrom. The nacelle air load during takeoff rotation operates to counteract the thrust load. The cumulative effect is a minimization of blade tip clearance requirements which improves engine performance. Since intermediate case distortion is minimized, the intermediate case may readily support other engine components such as an engine accessory gearbox, pumps, an oil tank and such like, which thereby saves weight and space within the core compartment.

[0008] Another mounting configuration removes the side load from the front mount such that the front mount reacts only the vertical loads. The side loads are reacted through a fixed moment rear mount.

[0009] The present invention therefore provides an engine mounting configuration which minimizes backbone bending and engine case distortion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently disclosed embodiment. The drawings that accompany the detailed description can be briefly described as follows:

[0011] FIG. **1**A is a general sectional view through a gas turbine engine along the engine longitudinal axis;

[0012] FIG. **1**B is a general sectional view through a gas turbine engine along the engine longitudinal axis illustrating an engine static structure case arrangement on the lower half thereof;

[0013] FIG. **1**C is a side view of an engine mounting configuration illustrating a rear mount attached through an engine thrust case to a mid-turbine frame between a first and second bearing supported thereby;

[0014] FIG. **1**D is a front perspective view of an engine mounting configuration illustrating a rear mount attached through an engine thrust case to a mid-turbine frame between a first and second bearing supported thereby;

[0015] FIG. **2**A is a front perspective view of an engine mount pylon illustrating the engine mounting configuration;

[0016] FIG. **2**B is a side view of an engine mount pylon illustrating the engine mounting configuration;

[0017] FIG. **2**C is a rear perspective view of an engine mount pylon illustrating the engine mounting configuration;

[0018] FIG. **2**D is bottom view of an engine mount pylon illustrating the engine mounting configuration;

[0019] FIG. **2**E is a front view of an engine mount pylon illustrating the engine mounting configuration;

[0020] FIG. **3** is a free body diagram illustrating loads reacted by the engine mounting configuration;

[0021] FIG. **4** is a schematic view of the engine mounting configuration illustrating engine centerline flexing due to engine thrust and nacelle air loads;

[0022] FIG. **5**A is a side partially phantom view of an engine mounting configuration illustrating an auxiliary component mounting location to the intermediate case and high pressure compressor case;

[0023] FIG. **5**B is an underside of the gas turbine engine of FIG. **5**A looking forward to illustrate the piggy-back of auxiliary components to the intermediate case;

[0024] FIG. **5**C is a side view of a gas turbine engine opposite FIG. **5**A illustrating an auxiliary component arrangement facilitated by the engine mounting configuration;

[0025] FIG. **5**D is a side view of the gas turbine engine illustrating potential nacelle profile reduction facilitated by the engine mounting configuration due to elimination of a lay shaft requirement and moving the accessories forward;

[0026] FIG. **6** is a free body diagram illustrating loads reacted by another engine mounting configuration;

[0027] FIG. **7**A is a side view of a gas turbine engine illustrating another engine mounting configuration in which the front mount of the pylon is attached to the outer periphery of the intermediate case;

[0028] FIG. **7**B is an underside view of the gas turbine engine of FIG. **7**A looking forward to illustrate the piggy-back of auxiliary components with the intermediate case; and